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(54) **LIGHT EMITTING DEVICE PACKAGE INCLUDING UV LIGHT EMITTING DIODE**

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H01L 33/00 (2010.01)

(52) **U.S. Cl.**
USPC **257/99**; 257/98; 257/81; 257/79; 257/677; 257/690; 438/106; 438/26; 438/34; 438/65

(58) **Field of Classification Search**
USPC 257/99, 98, 81, 100, 132, 432, 434, 257/668, 677, 690, 79; 438/106, 26, 34, 65
See application file for complete search history.

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(57) **ABSTRACT**

Provided is a light emitting device package, which includes a ceramic body, an ultraviolet light emitting diode, a support member, and a glass film. The ceramic body defines a cavity. The ultraviolet light emitting diode is disposed within the cavity. The support member is disposed on the body, and surrounds the cavity. The glass film is coupled to the support member, and covers the cavity. Since the light emitting device package includes the ceramic body to efficiently dissipate heat, and the glass film is directly attached to the ceramic body to decrease the number of components, thereby simplifying the manufacturing process thereof, and reducing the manufacturing costs thereof.

19 Claims, 6 Drawing Sheets

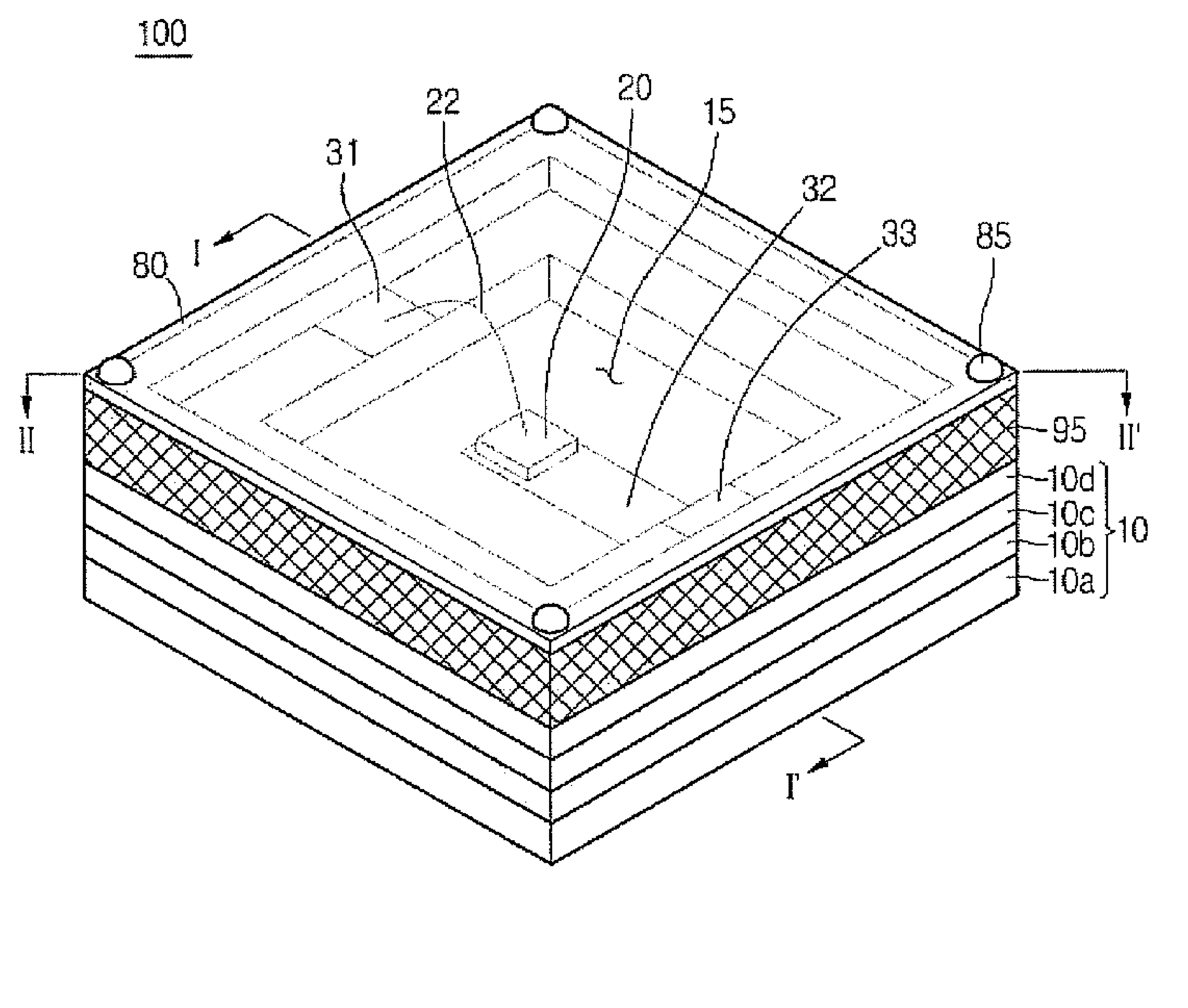
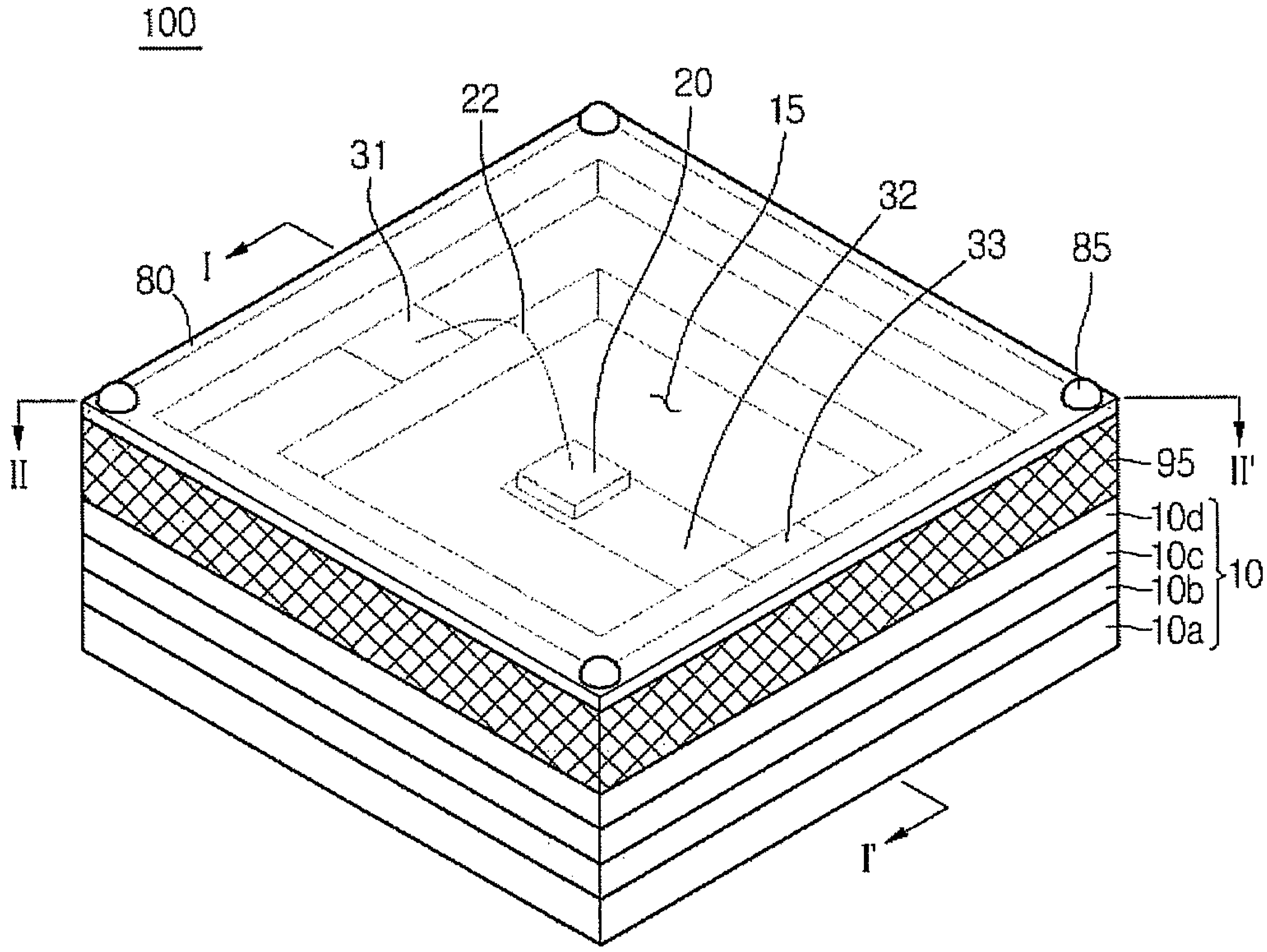


FIG. 1


100
22
20
15
31
32
33
85
80
I
II
II'
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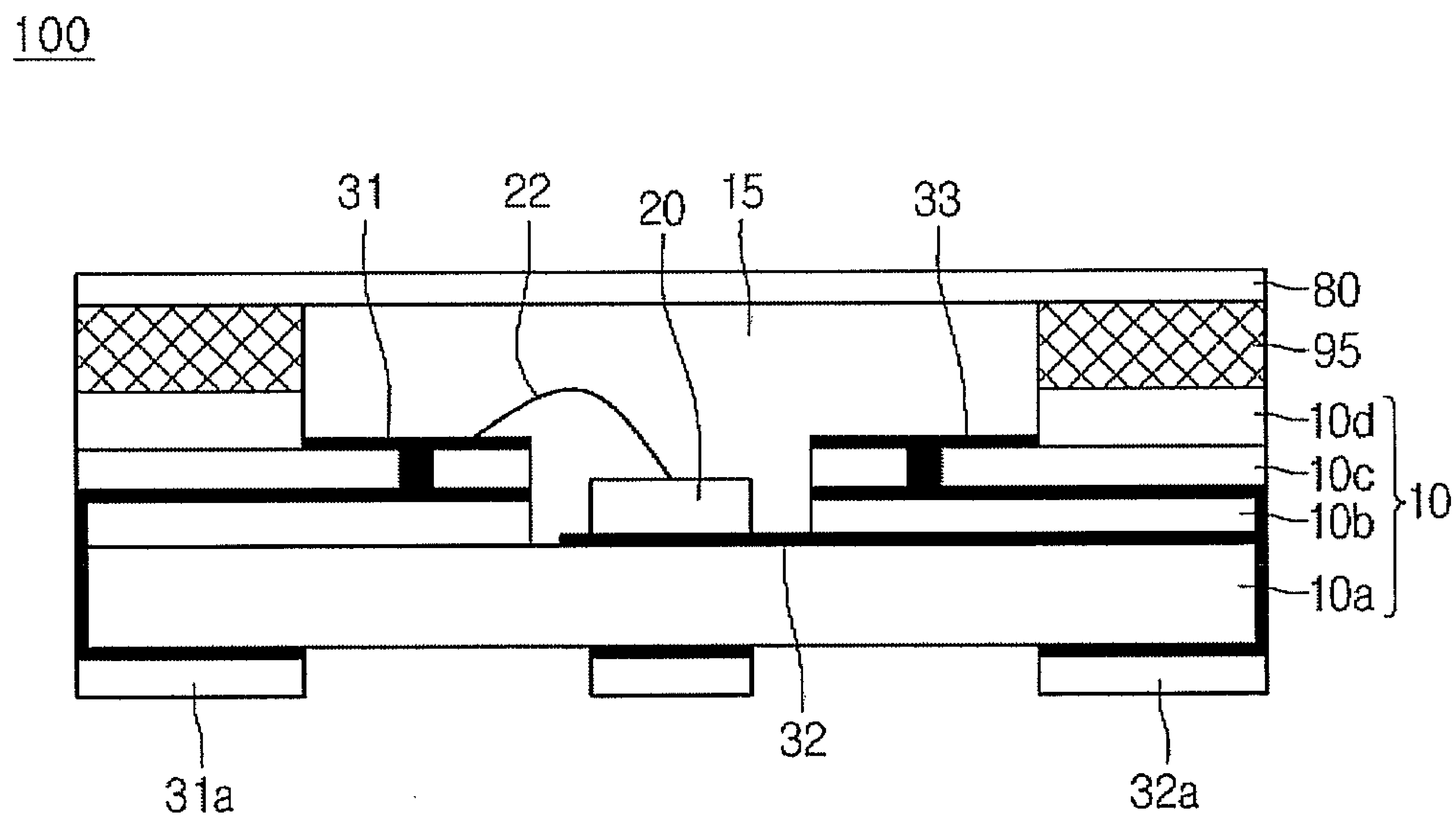
10d
10c
10b
10a
10
I'

FIG. 2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31a
32a

FIG. 3

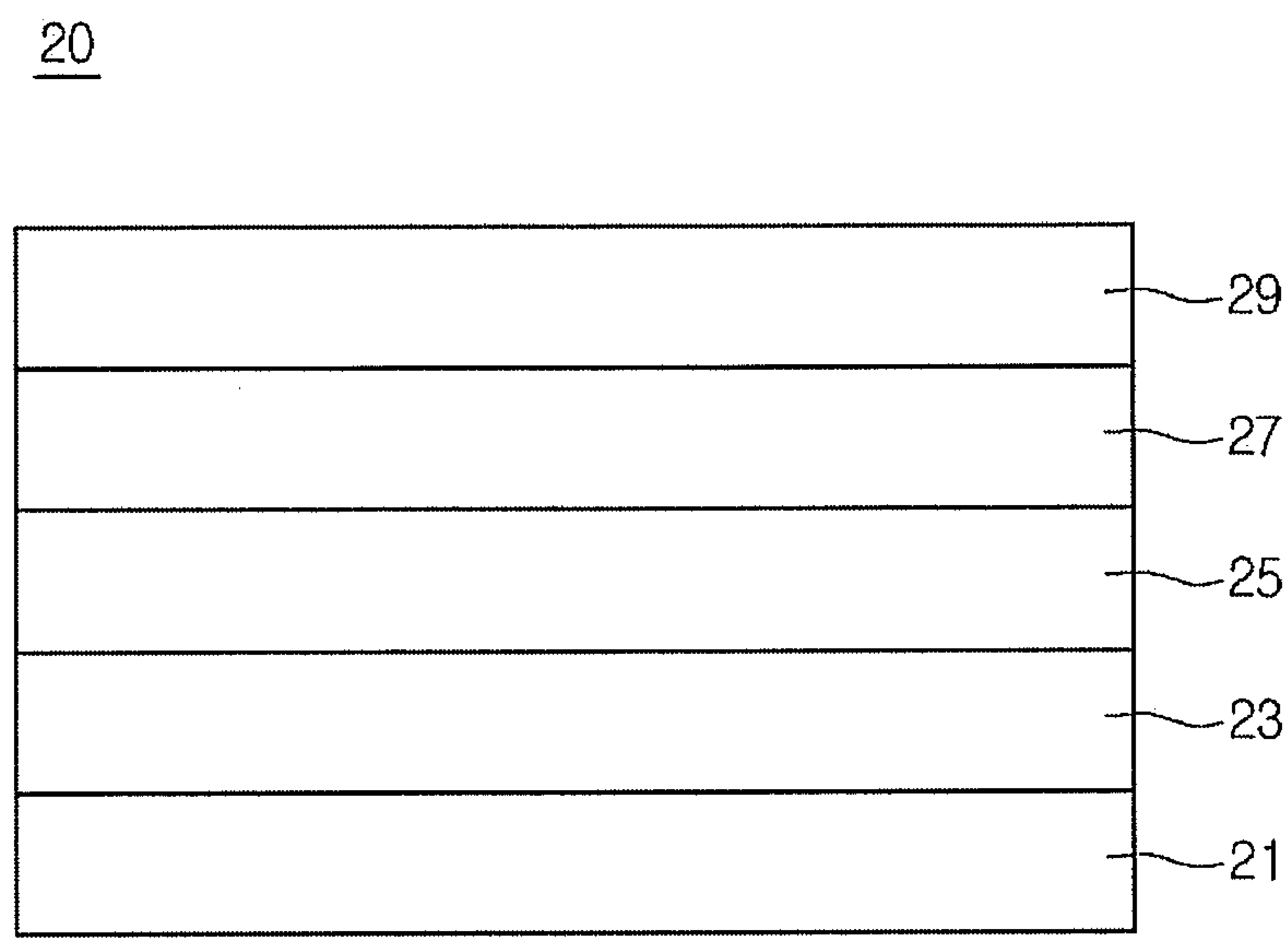


FIG. 4

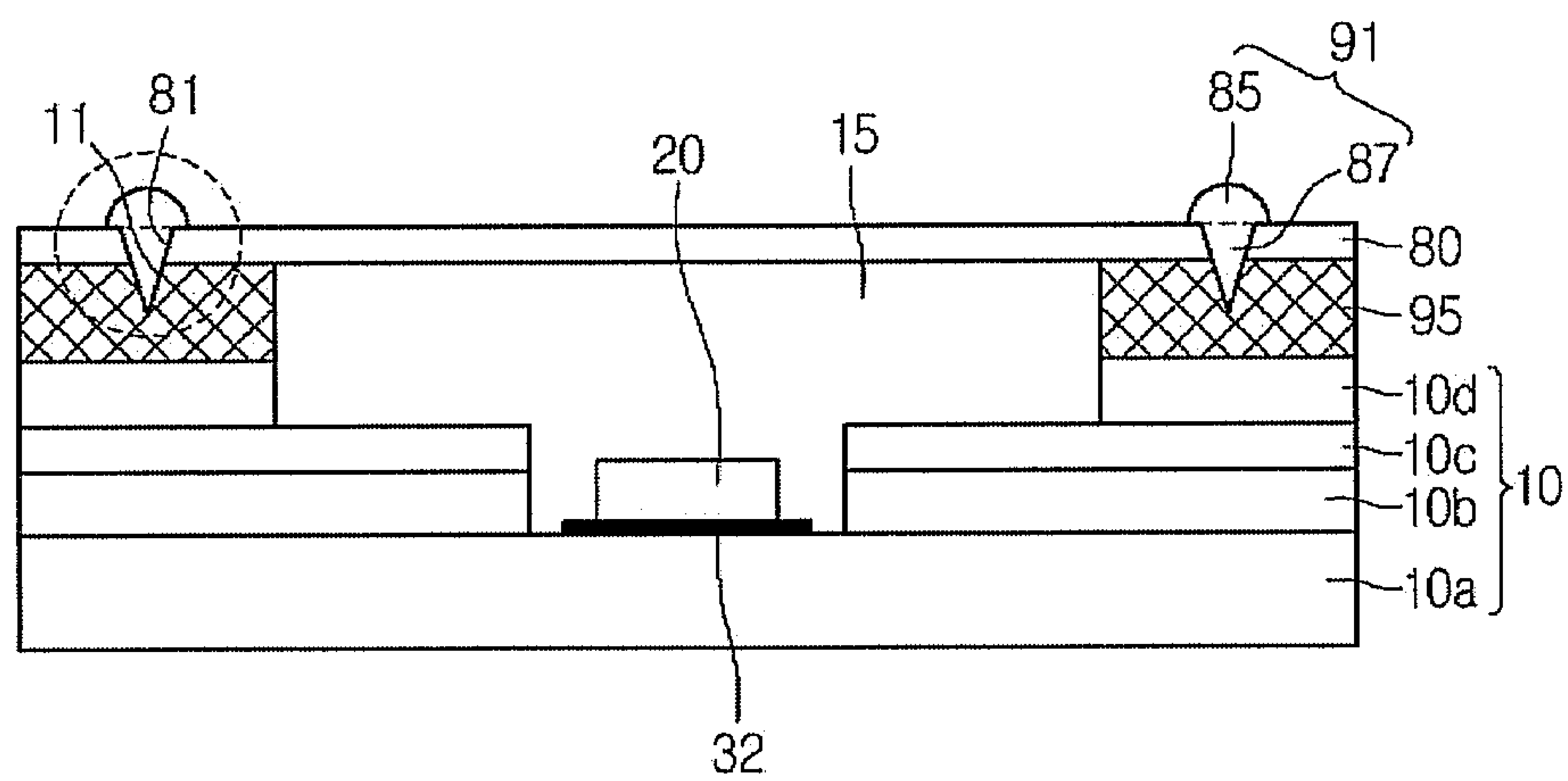


FIG. 5

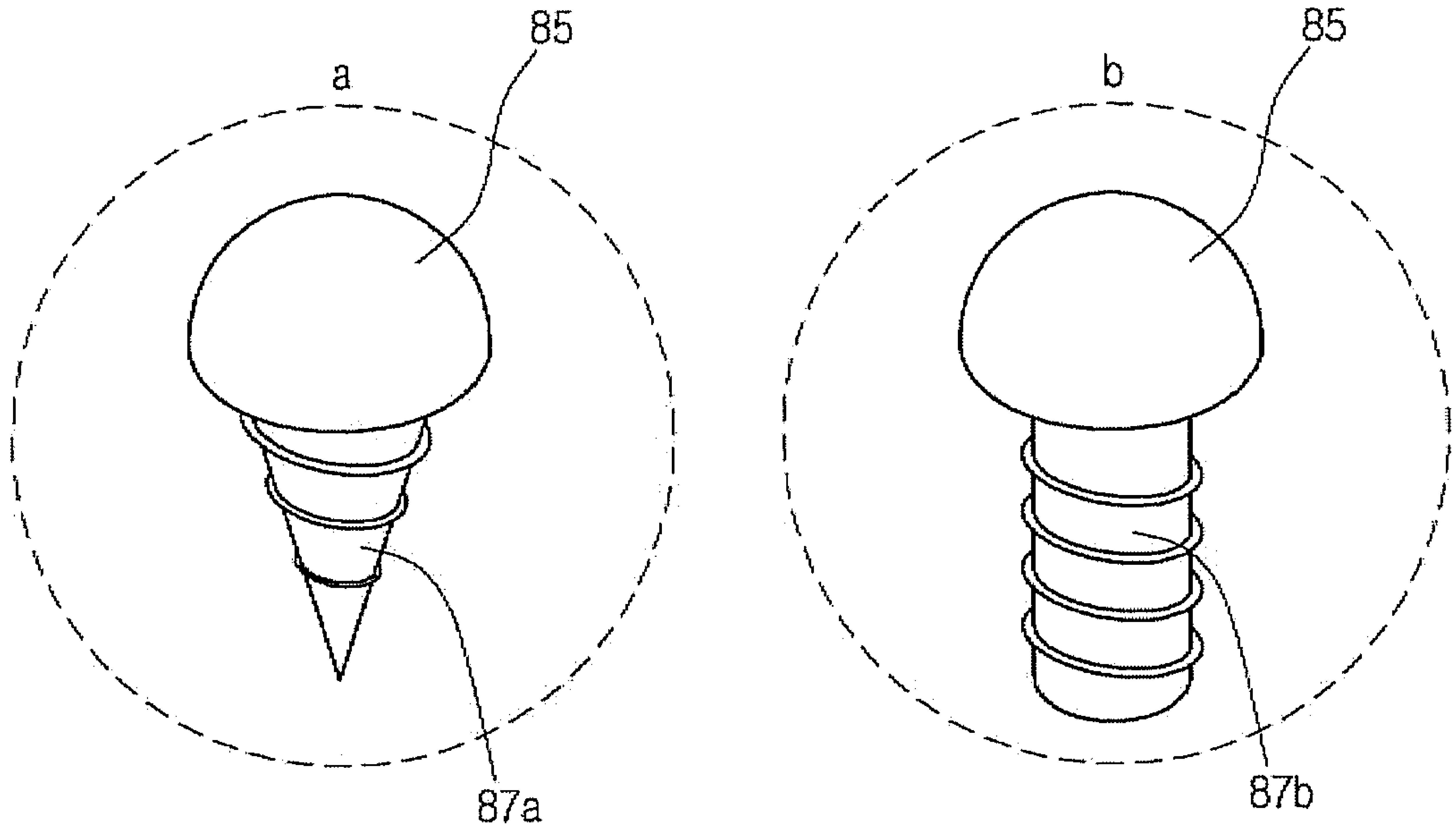


FIG. 6

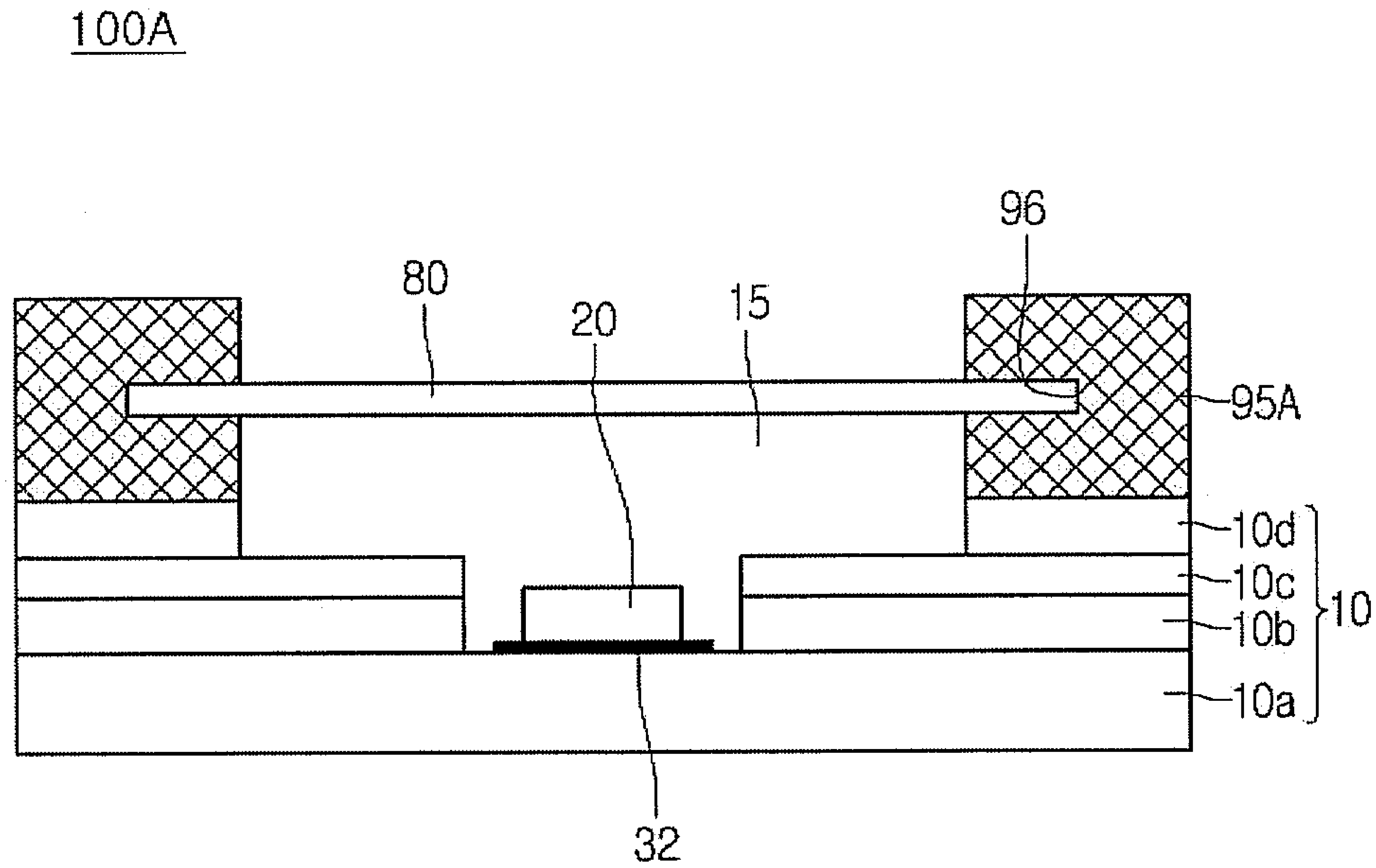
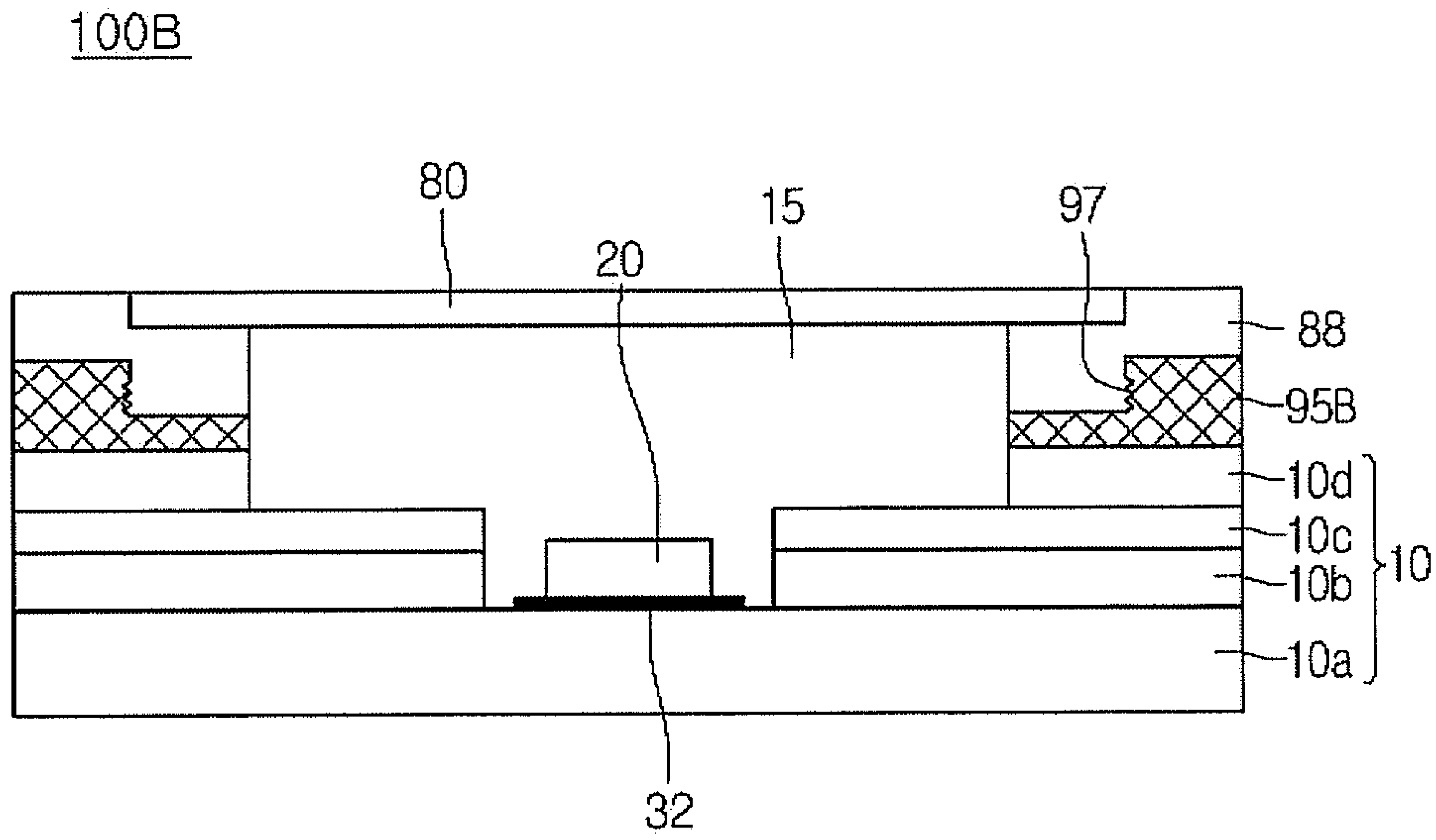


FIG. 7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20
15
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88
95B
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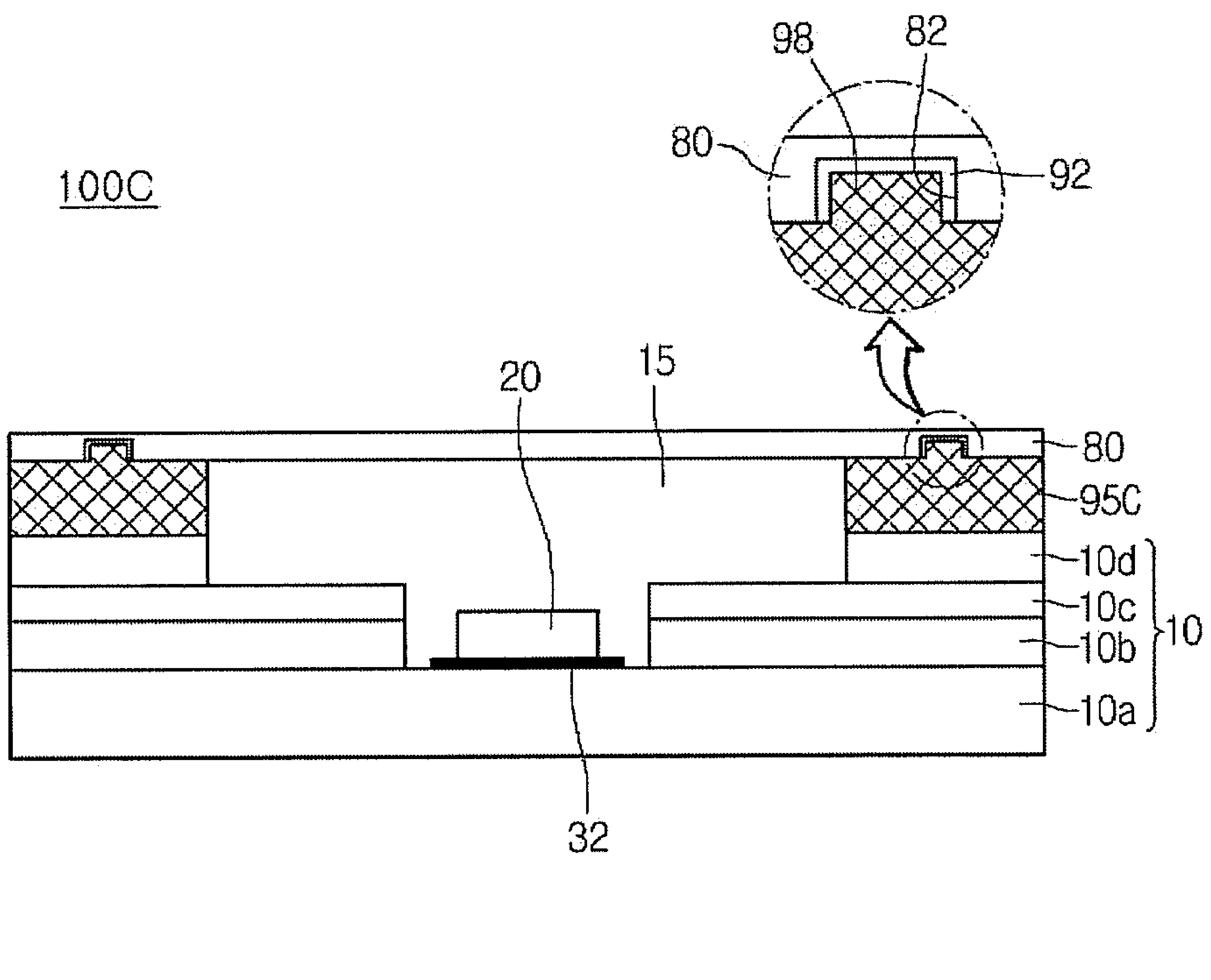
10c
10b
10
10a
32

FIG. 8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95C
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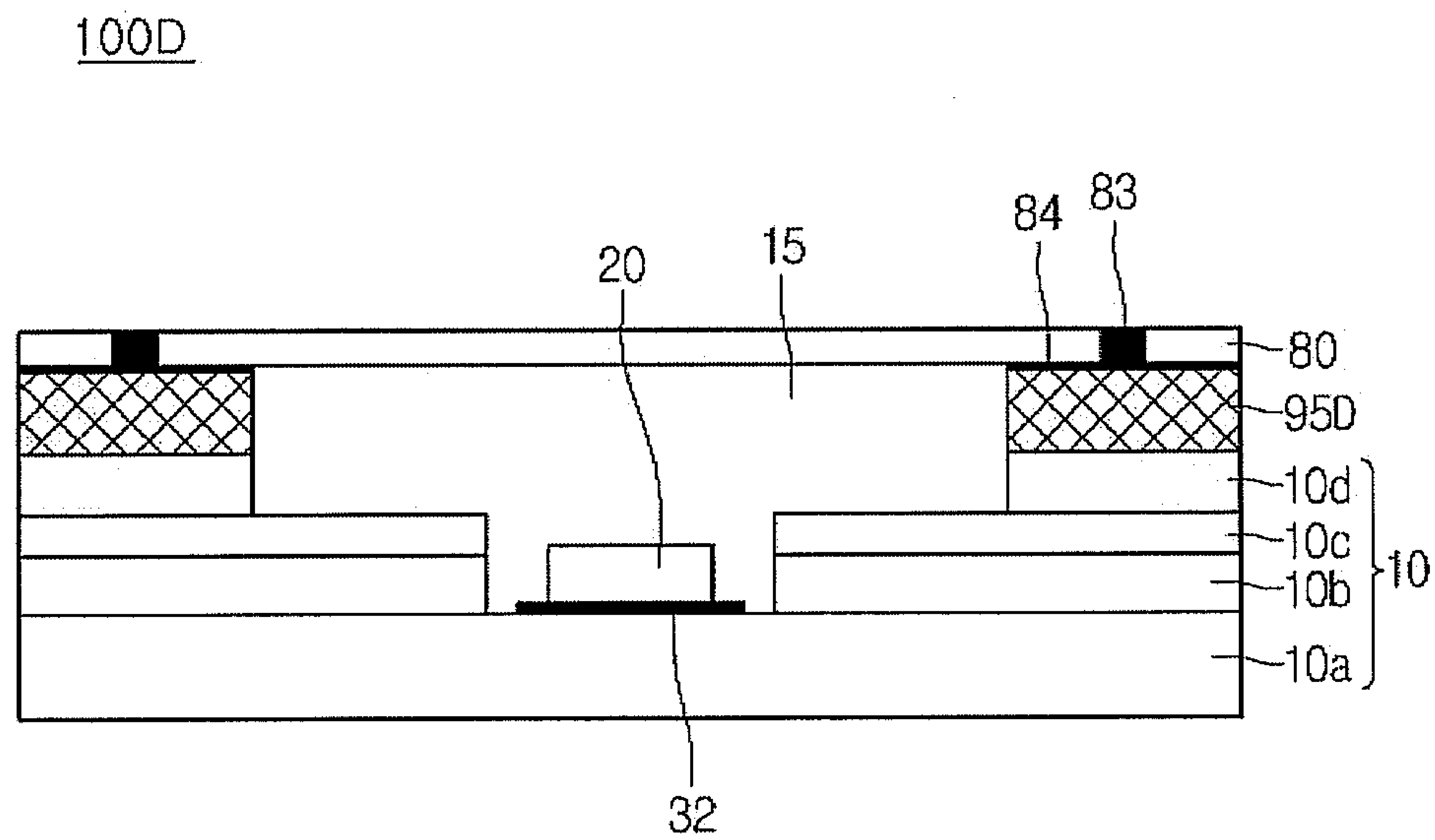
10c
10b
10
10a
32

FIG. 9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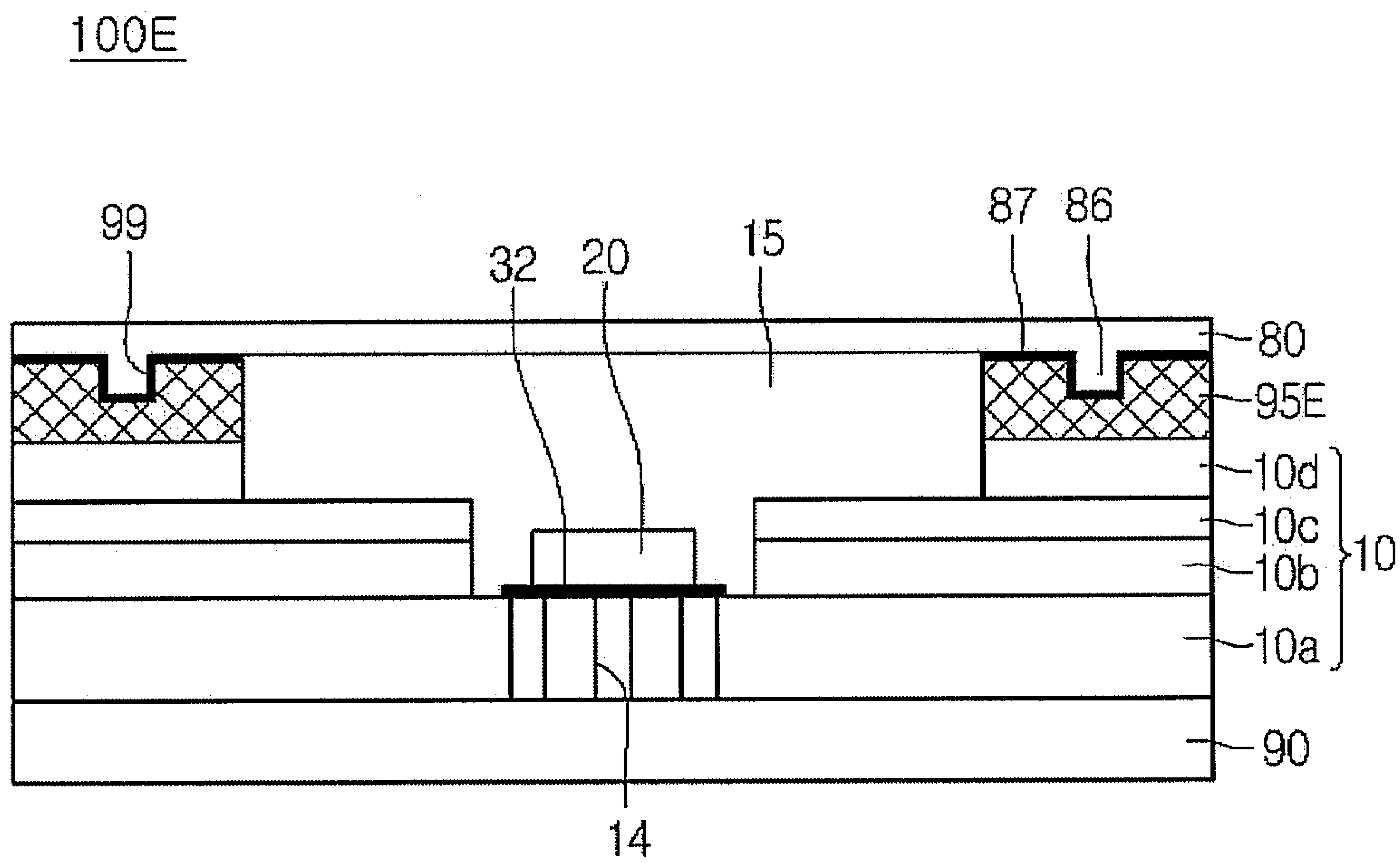
32

FIG. 10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95E
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10b
10a
10
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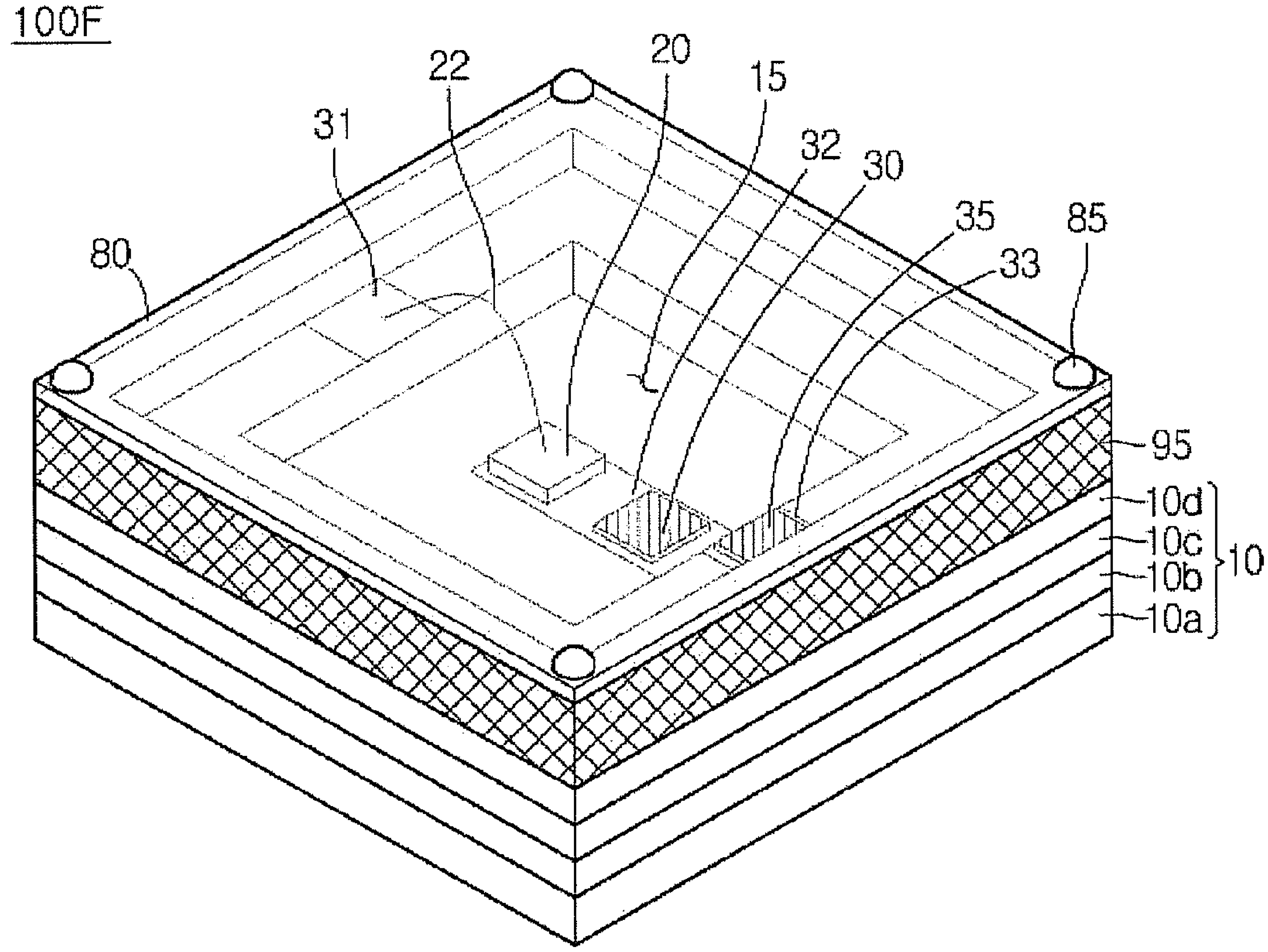
14

FIG. 11



LIGHT EMITTING DEVICE PACKAGE INCLUDING UV LIGHT EMITTING DIODE

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims priority under 35 U.S.C. 119 and 35 U.S.C. 365 to Korean Patent Application No. 10-2011-0036931 (filed on Apr. 20, 2011), which is hereby incorporated by reference in its entirety.

BACKGROUND

The present disclosure relates to a light emitting device package including an ultraviolet light emitting diode.

Light emitting diodes (LEDs) may constitute light emitting sources by using compound semiconductor materials such as GaAs-based materials, AlGaAs-based materials, GaN-based materials, InGaN-based materials, and InGaAlP-based materials.

Such light emitting diodes are packaged as a light emitting device package that emits beams of various colors. Light emitting device packages are used as light sources in various fields for displaying colors, e.g., lighting displays, character displays, and image displays.

Particularly, ultraviolet (UV) LEDs emit rays of a wavelength ranging from about 245 nm to 405 nm. Of these, rays of a short wavelength have sterilizing and purifying functions, and rays of a long wavelength may be used in an exposure apparatuses or a curing apparatus.

However, UV LEDs generate a large amount of heat while emitting light, which causes a defect and degrades operation reliability. In addition, when a package size of UV LEDs is increased to improve heat dissipation efficiency, integration efficiency and economic efficiency are jeopardized.

SUMMARY

Embodiments provide a light emitting device package having an improved structure.

Embodiments provide an ultraviolet light emitting device package that has appropriate heat dissipation efficiency and is compatible with various devices, regardless of wavelengths.

In one embodiment, a light emitting device package includes a ceramic body, an ultraviolet light emitting diode, a support member, and a glass film. The ceramic body defines a cavity. The ultraviolet light emitting diode is disposed within the cavity. The support member is disposed on the body, and surrounds the cavity. The glass film is coupled to the support member, and covers the cavity.

The details of one or more embodiments are set forth in the accompanying drawings and the description below. Other features will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view illustrating a light emitting device package according to a first embodiment.

FIG. **2** is a cross-sectional view taken along line I-I' of FIG. **1**.

FIG. **3** is a cross-sectional view illustrating a light emitting diode of FIG. **1**.

FIG. **4** is a cross-sectional view taken along line II-II' of FIG. **1**.

FIGS. **5**A and **5**B are perspective views illustrating examples of a portion defined by a dotted circle of FIG. **4**.

FIG. **6** is a cross-sectional view illustrating a light emitting device package according to a second embodiment.

FIG. **7** is a cross-sectional view illustrating a light emitting device package according to a third embodiment.

FIG. **8** is a cross-sectional view illustrating a light emitting device package according to a fourth embodiment.

FIG. **9** is a cross-sectional view illustrating a light emitting device package according to a fifth embodiment.

FIG. **10** is a cross-sectional view illustrating a light emitting device package according to a sixth embodiment.

FIG. **11** is a perspective view illustrating a light emitting device package according to a seventh embodiment.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings in such a manner that the technical idea of the present invention may easily be carried out by a person with ordinary skill in the art to which the invention pertains. The present disclosure may, however, be embodied in different forms and should not be construed as limited to the embodiments set forth herein.

In this specification, when it is described that one comprises (or includes or has) some elements, it should be understood that it may comprise (or include or has) only those elements, or it may comprise (or include or have) other elements as well as those elements if there is no specific limitation.

In the drawings, anything unnecessary for describing the present disclosure will be omitted for clarity, and thicknesses are enlarged for the purpose of clearly illustrating layers and areas. Like reference numerals in the drawings denote like elements, and thus their descriptions will be omitted.

In the specification, it will be understood that when a layer, a film, a region, or a plate is referred to as being 'on' another layer, film, region, or plate, it can be directly on the other layer, region, or plate, or intervening layers, films, regions, or plates may also be present. On the other hand, it will also be understood that when a layer, a film, an area or a plate is referred to as being "directly on" another one, intervening layers, films, areas, and plates may not be present.

Hereinafter, a light emitting device package according to a first embodiment will now be described with reference to FIGS. **1** to **5**.

FIG. **1** is a perspective view illustrating a light emitting device package according to the first embodiment. FIG. **2** is a cross-sectional view taken along line I-I' of FIG. **1**. FIG. **3** is a cross-sectional view illustrating a light emitting diode of FIG. **1**. FIG. **4** is a cross-sectional view taken along line II-II' of FIG. **1**. FIGS. **5**A and **5**B are perspective views illustrating examples of a portion defined by a dotted circle of FIG. **4**.

Referring to FIGS. **1** to **3**, a light emitting device package **100** includes: a body **10**; at least one light emitting diode **20** disposed on the body **10**; and first and second electrodes **31** and **32** disposed on the body **10**, and electrically connected to the light emitting diode **20**.

Further, the light emitting device package **100** includes a light transmitting film **80** protecting the light emitting diode **20**, and a support member **95** supporting the light transmitting film **80**.

The body **10** is formed by stacking insulating layers **10**_a_, **10**_b_, **10**_c_, and **10**_d_, which are formed of ceramic materials. The body **10** may be formed of a low temperature co-fired ceramic (LTCC) or high temperature co-fired ceramic

(HTCC), which is obtained by co-firing the insulating layers **10***a*, **10***b*, **10***c*, and **10***d* between which a metal pattern may be disposed.

The insulating layers **10***a*, **10***b*, **10***c*, and **10***d* of the body **10** may be formed of a nitride or oxide, and the nitride improves heat conductivity.

The insulating layers **10***a*, **10***b*, **10***c*, and **10***d* may be formed of SiO_2, Si_xO_y, Si_3N_4, Si_xN_y, SiO_xN_y, Al_2O_3, or AlN, preferably, be formed of AlN.

An upper opening of the body **10** may be formed by a cavity **15**.

The cavity **15** may be defined by the insulating layers **10***a*, **10***b*, **10***c*, and **10***d*. As illustrated in FIGS. **2** and **4**, the first insulating layer **10***a* is a base insulating layer having no pattern, and the second and third insulating layers **10***b* and **10***c* have a central opening in which the light emitting diode **20** is mounted. The fourth insulating layer **10***d* disposed on the third insulating layer **10***c* has an opening greater than that of the third insulating layer **10***c*, so as to form the cavity **15**.

However, the shape of the cavity **15** for mounting the light emitting diode **20** is not limited thereto, and thus, may be varied according to a design of the insulating layers **10***a*, **10***b*, **10***c*, and **10***d*.

The cavity **15** may have a cup or concave container shape, and be formed through punching between the insulating layers **10***a*, **10***b*, **10***c*, and **10***d*, and thus, have a side surface perpendicular to a bottom surface.

The cavity **15** may have a circular, tetragonal, polygonal, or oval shape from a plan view.

The first and second electrodes **31** and **32** may be disposed between the insulating layers **10***a*, **10***b*, **10***c*, and **10***d*. The first electrode **31** and the second electrode **32** are electrically separated from each other as positive and negative electrodes in order to supply power to the light emitting diode **20**. Other electrodes than the first electrode **31** and the second electrode **32** may be provided according to a design of the light emitting diode **20**, but the present disclosure is not limited thereto.

The first electrode **31** and the second electrode **32** may have a multi layered structure. For example, the first electrode **31** and the second electrode **32** may be a Ti/Cu/Ni/Au layer formed by sequentially stacking titanium (Ti), copper (Cu), nickel (Ni), and gold (Au).

That is, the lowermost layer of the first electrode **31** and the second electrode **32** is formed of a material efficiently adhered to the insulating layers **10***a*, **10***b*, **10***c*, and **10***d*, such as titanium (Ti), chrome (Cr), and tantalum (Ta); the uppermost layer of the first electrode **31** and the second electrode **32** is formed of a material having excellent electric conductivity, such as gold (Au) to which a wire is efficiently attached; and a diffusion barrier layer formed of platinum (Pt), nickel (Ni), or copper (Cu) may be disposed between the lowermost layer and the uppermost layer. However, the present disclosure is not limited thereto.

The first electrode **31** and the second electrode **32** are patterned and disposed between the insulating layers **10***a*, **10***b*, **10***c*, and **10***d*, and then, are fired together with the insulating layers **10***a*, **10***b*, **10***c*, and **10***d*.

The first electrode **31** is exposed on the third insulating layer **10***c*, and is connected to a metal pattern disposed on the second insulating layer **10***b* through a via passing through the third insulating layer **10***c*, so that the first electrode **31** can be connected along a side surface of the body **10** to a first pad **31***a* disposed on the bottom surface of the body **10**.

The second electrode **32** extends on the first insulating layer **10***a* exposed through the second insulating layer **10***b*, and is connected along a side surface of the body **10** to a second pad **32***a* disposed on the bottom surface of the body **10**.

Electric current is applied to the first and second electrodes **31** and **32** through the first and second pads **31***a* and **32***a*. The configuration of the first and second electrodes **31** and **32** is not limited thereto, provided that they are separated from each other between the insulating layers **10***a*, **10***b*, **10***c*, and **10***d*.

Referring to FIG. **2**, a dummy electrode **33** may be disposed on the third insulating layer **10***c* to electrically connect to the second electrode **32**. The dummy electrode **33** may be electrically connected to a device other than the light emitting diode **20**.

The second electrode **32** is disposed on an exposed portion of the first insulating layer **10***a*, that is, on the bottom of the cavity **15**, and thus, functions as a mounting pad on which the light emitting diode **20** is mounted.

The first electrode **31** may be electrically connected to the top surface of the light emitting diode **20** through a wire **22**.

A cathode mark (not shown) may be formed on the body **10** to discriminate the first and second electrodes **31** and **32** from each other, but the present invention is not limited thereto.

A reflective layer (not shown) may be disposed over the first and second electrodes **31** and **32** on the top surface of the body **10**.

The light emitting diode **20** may be mounted on the body **10** within the cavity **15**.

At least one light emitting diode **20** may be mounted on the body **10** according to a design of the light emitting device package **100**. When the light emitting device package **100** is provided in plurality, a plurality of electrodes for supplying power to the light emitting device packages **100**, and a plurality of reflective layers may be provided, but the present disclosure is not limited thereto.

The light emitting diode **20** may be directly mounted on the insulating layer **10***a*, **10***b*, **10***c*, or **10***d*, or be electrically adhered to the first or second electrode **31** or **32**.

The light emitting diode **20** may be an ultraviolet light emitting diode having a wavelength ranging from about 245 nm to 405 nm. That is, the light emitting diode **20** may emit an ultraviolet ray having a short wavelength of about 280 nm, or an ultraviolet ray having a long wavelength of about 365 nm or 385 nm.

The light emitting diode **20** may be mounted using a wire bonding method, a die bonding method, or a flip bonding method, which may be selected according to the type of a chip and the position of an electrode of the chip.

The light emitting diode **20** may include a group III-V compound semiconductor such as AlInGaN, InGaN, GaN, GaAs, InGaP, AlInGaP, InP, and InGaAs.

The light emitting diode **20** may be adhered to the second electrode **32** through a conductive adhesive, and be electrically connected to the first electrode **31** through the wire **22**.

The light emitting diode **20** is called a vertical light emitting device, and includes, as illustrated in FIG. **3**, a conductive support substrate **21**, a bonding layer **23**, a second conductive type semiconductor layer **25**, an active layer **27**, and a first conductive type semiconductor layer **29**.

The conductive support substrate **21** may include a metal or an electrically conductive semiconductor substrate.

A group III-V nitride semiconductor layer is disposed on the conductive support substrate **21**. In this case, an electron beam evaporator, a physical vapor deposition (PVD) apparatus, a chemical vapor deposition (CVD) apparatus, a plasma laser deposition (PLD) apparatus, a sputtering apparatus including a dual-type thermal evaporator, or a metal organic chemical vapor deposition (MOCVD) apparatus may be used as a semiconductor growing apparatus, but the present disclosure is not limited thereto.

The bonding layer **23** may be disposed on the conductive support member **21**. The bonding layer **23** adheres the conductive support substrate **21** to the group III-V nitride semiconductor layer. The conductive support substrate **21** may be formed using a plating method instead of a bonding method. In this case, the bonding layer **23** may be removed.

The second conductive type semiconductor layer **25** is disposed on the bonding layer **23**, and is electrically connected to the second electrode **32** through the bonding layer **23** and the conductive support substrate **21**.

The second conductive type semiconductor layer **25** may be formed of a group III-V compound semiconductor, e.g., at least one of GaN, InN, AlN, InGaN, AlGaN, InAlGaN, and AlInN. The second conductive type semiconductor layer **25** may be doped with a second conductive type dopant that includes Mg, Zn, Ca, Sr, or Ba as a P type dopant.

For example, the second conductive type semiconductor layer **25** may be formed as a p type GaN layer having a certain thickness by supplying gas including NH_3, TMGa (or TEGa), and a p type dopant such as Mg.

The second conductive type semiconductor layer **25** has a current spreading structure in a certain region. The current spreading structure includes semiconductor layers in which a horizontal current spreading speed is higher than a vertical current spreading speed.

For example, the current spreading structure may include semiconductor layers that are different in dopant concentration or conductivity.

The second conductive type semiconductor layer **25** may uniformly diffuse carriers into a layer disposed thereon, e.g., into the active layer **27**.

The active layer **27** is disposed on the second conductive type semiconductor layer **25**. The active layer **27** may have a single quantum well structure or a multi quantum well (MQW) structure. The active layer **27** may selectively include a period of InGaN/GaN, a period of AlGaN/InGaN, a period InGaN/InGaN, and a period of AlGaN/GaN.

A second conductive type clad layer (not shown) may be disposed between the second conductive type semiconductor layer **25** and the active layer **27**. The second conductive type clad layer may be formed of a p type GaN-based semiconductor. The second conductive type clad layer may be formed of a material having a band gap higher than that of a well layer.

The first conductive type semiconductor layer **29** is disposed on the active layer **27**. The first conductive type semiconductor layer **29** may be an n type semiconductor layer doped with a first conductive type dopant. The n type semiconductor layer may be formed of a compound semiconductor such as GaN, InN, AlN, InGaN, AlGaN, InAlGaN, or AlInN. The first conductive type dopant as an n type dopant may include at least one of Si, Ge, Sn, Se, and Te.

For example, the first conductive type semiconductor layer **29** may be formed as an n type GaN layer having a certain thickness by supplying gas including NH_3, TMGa (or TEGa), and an n type dopant such as Si.

The second conductive type semiconductor layer **25** may be formed as a p type semiconductor layer, and the first conductive type semiconductor layer **29** may include an n type semiconductor layer. A light emitting structure may have one of an n-p junction structure, a p-n junction structure, an n-p-n junction structure, and a p-n-p junction structure. Hereinafter, the first conductive type semiconductor layer **29** is exemplified as the uppermost layer of a semiconductor layer.

At least one of a first electrode and an electrode layer (not shown) may be disposed on the first conductive type semiconductor layer **29**. The electrode layer may include an oxide or nitride-based light transmitting layer, for example, be formed of a material selected from ITO (indium tin oxide), ITON (indium tin oxide nitride), IZO (indium zinc oxide), IZON (indium zinc oxide nitride), IZTO (indium zinc tin oxide), IAZO (indium aluminum zinc oxide), IGZO (indium gallium zinc oxide), IGTO (indium gallium tin oxide), AZO (aluminum zinc oxide), ATO (antimony tin oxide), GZO (gallium zinc oxide), IrO_x, RuO_x, and NiO. The electrode layer may function as a current spreading layer for spreading current.

The electrode layer may be a reflective electrode layer that may be formed of a material selected from Ag, Ni, Al, Rh, Pd, Ir, Ru, Mg, Zn, Pt, Au, Hf, and a combination thereof. The first electrode may include a metal layer having a single or multi-layered structure. For example, the metal layer may be formed of at least one of Ag, Ni, Al, Rh, Pd, Ir, Ru, Mg, Zn, Pt, Au, Hf, and an alloy thereof.

A plurality of the light emitting diodes **20** may be mounted on the body **10**.

The light emitting diode **20** may be mounted on the second electrode **32** and be electrically connected thereto, and be electrically connected to the first electrode **31** through the wire **22**.

For example, an end of the wire **22** may be bonded to the first electrode **31**, and the other end thereof may be bonded to the light emitting diode **20**, but the present disclosure is not limited thereto.

The cavity **15** may be filled with inert gas, instead of a sealing material. That is, the cavity **15** may be filled with inert gas such as nitrogen to protect the light emitting diode **20** from environmental conditions such as moisture and oxygen.

The light transmitting film **80** as a hard glass film is disposed over the body **10** to cover the cavity **15**.

The light transmitting film **80** may be formed of a transparent material such as LiF, MgF_2, CaF_2, BaF_2, Al_2O_3, SiO_2, and optical glass (N-BK7○R). Examples of SiO_2 may be quartz crystal and UV Fused Silica.

Furthermore, the light transmitting film **80** may be formed of low iron glass.

The support member **95** is disposed on the fourth insulating layer **10*d*** as the uppermost layer of the body **10** to support the light transmitting film **80**.

The support member **95** is disposed on the body **10** to form a certain space between the light transmitting film **80** and a portion of the cavity **15** corresponding to the body **10**.

The support member **95** and the fourth insulating layer **10*d*** may be integrally formed of the same material. Alternatively, the support member **95** may be formed of a material, such as a metal, different from that of the fourth insulating layer **10*d***, and be attached thereto.

The support member **95** may be a ring type or a frame type support member disposed on the fourth insulating layer **10*d*** to surround an open region of the fourth insulating layer **10*d***.

The light transmitting film **80** may be attached to the top surface of the support member **95** through an adhesive, without using laser or soldering, thereby simplifying the manufacturing process thereof and reducing costs.

Hereinafter, a method of attaching the light transmitting film **80** to the support member **95** according to the first embodiment will now be described with reference to FIGS. **4** and **5**.

Referring to FIG. **4**, the light emitting device package **100** includes coupling pins **91** passing through the top surface of the support member **95** and the light transmitting film **80**.

In detail, support recesses **11** are disposed in the support member **95** to receive the coupling pins **91**, and the light transmitting film **80** includes glass holes **81** aligned with the support recesses **11** to receive the coupling pins **91**.

Referring to FIG. **4**, the coupling pin **91** includes a pin head **85** and a pin body **87**. A diameter of the pin head **85** is greater than a diameter of the pin body **87** that may have a conic shape that decreases in diameter in a direction away from the pin head **85**.

The diameter of the pin head **85** is greater than a diameter of the glass hole **81**, and the pin body **87** is fitted in the glass hole **81** and the support recess **11**, thereby coupling the light transmitting film **80** to the support member **95**.

Although the pin head **85** has a hemispheric shape as illustrated in FIG. **4**, the pin head **85** may have a flat top surface, and have a circular or polygonal cross section.

Referring to FIG. **5**A, a pin body **87***a* of the coupling pin **91** has a conic shape that decreases in diameter in the direction away from the pin head **85**. A screw thread protrusion is formed on the surface of the conic shape, and a screw thread recess that is coupled to the screw thread protrusion is formed in the side surfaces of the support recess **11** and the glass hole **81**, so that the coupling pin **91** can be screwed to the support recess **11** and the glass hole **81**.

Referring to FIG. **5**B, a pin body **87***b* of the coupling pin **91** may have a cylindrical shape that has a constant diameter to an end thereof from the pin head **85**. A screw thread protrusion is formed on the surface of the cylindrical shape, and a screw thread recess that is coupled to the screw thread protrusion is formed in the side surfaces of the support recess **11** and the glass hole **81**, so that the coupling pin **91** can be screwed to the support recess **11** and the glass hole **81**.

As such, the shape of the coupling pins **91** may be varied, and the coupling pins **91** are coupled to the support member **95** through the light transmitting film **80** to thereby couple the light transmitting film **80** to the support member **95**.

An adhesive (not shown) may be applied between the light transmitting film **80** and the top surface of the support member **95**, and may be a Ag paste, a UV adhesive, Pb-free low temperature glass, an acrylic adhesive, or a ceramic adhesive.

The body **10** is formed of ceramic so as to dissipate heat due to a UV wavelength, without increasing the size of the light emitting device package **100**. Accordingly, the light emitting device package **100** can have a constant package structure, regardless of a wavelength of light emitted from the light emitting diode **20**, and thus, can be compatible with various light emitting diodes for emitting various beams of different wavelengths.

Hereinafter, a light emitting device package according to a second embodiment will now be described with reference to FIG. **6**.

Referring to FIG. **6**, a light emitting device package **100**A includes: a body **10** formed of ceramic; at least one light emitting diode **20** disposed on the body **10**; and first and second electrodes (not shown) disposed on the body **10**, and electrically connected to the light emitting diode **20**.

Further, the light emitting device package **100**A includes a light transmitting film **80** protecting the light emitting diode **20**, and a support member **95**A supporting the light transmitting film **80**.

Since the body **10**, insulating layers **10***a*, **10***b*, **10***c*, and **10***d*, the light emitting diode **20**, and the electrodes of the light emitting device package **100**A are similar in configuration to those of the light emitting device package **100** of FIGS. **1** to **3**, a description thereof will be omitted.

Referring to FIG. **6**, the support member **95**A is provided with a glass recess **96** in which the light transmitting film **80** is slid.

The glass recess **96** is disposed in the side inner wall of the support member **95**A adjacent to the body **10**, and has a height equal to or greater than the thickness of the light transmitting film **80**.

The light transmitting film **80** is laterally slid along the glass recess **96** to seal a cavity **15**.

An adhesive (not shown) may be applied within the glass recess **96**.

The adhesive may be a Ag paste, a UV adhesive, Pb-free low temperature glass, an acrylic adhesive, or a ceramic adhesive.

As such, the glass recess **96** is disposed in the side inner wall of the support member **95**A, so that the light transmitting film **80** is slid and coupled to the support member **95**A with the adhesive applied therebetween, thereby improving coupling force thereof.

Hereinafter, a light emitting device package according to a third embodiment will now be described with reference to FIG. **7**.

Referring to FIG. **7**, a light emitting device package **100**B includes: a body **10** formed of ceramic; at least one light emitting diode **20** disposed on the body **10**; and first and second electrodes (not shown) disposed on the body **10**, and electrically connected to the light emitting diode **20**.

Further, the light emitting device package **100**B includes a light transmitting film **80** protecting the light emitting diode **20**, and a support member **95**B supporting the light transmitting film **80**.

Since the body **10**, insulating layers **10***a*, **10***b*, **10***c*, and **10***d*, the light emitting diode **20**, and the electrodes of the light emitting device package **100**B are similar in configuration to those of the light emitting device package **100** of FIGS. **1** to **3**, a description thereof will be omitted.

Referring to FIG. **7**, the light emitting device package **100**B further includes a glass case **88** coupled to the light transmitting film **80** and screwed to the support member **95**B.

The glass case **88** includes an upper inner step structure on which the light transmitting film **80** is placed, and an lower outer step structure coupled to the support member **95**B.

A screw thread recess that is screwed to the support member **95**B is disposed in a side wall of the lower outer step structure.

The support member **95**B includes an upper step structure coupled to the glass case **88**, and a screw thread protrusion **97** is disposed on a side wall of the upper step structure to engage with the screw thread recess of the glass case **88**.

The light transmitting film **80** may be coupled to the support member **95**B by screwing the glass case **88**, integrally formed with the light transmitting film **80**, to the support member **95**B.

The glass case **88** and the light transmitting film **80** may be integrally formed of the same material at the same time, or the glass case **88** may be a metal member coupled to the light transmitting film **80**.

The light transmitting film **80** can be easily coupled to the light emitting device package **100**B by just screwing the glass case **88**, to which the light transmitting film **80** is attached, to the support member **95**B.

Hereinafter, a light emitting device package according to a fourth embodiment will now be described with reference to FIG. **8**.

Referring to FIG. **8**, a light emitting device package **100**C includes: a body **10** formed of ceramic; at least one light emitting diode **20** disposed on the body **10**; and first and second electrodes (not shown) disposed on the body **10**, and electrically connected to the light emitting diode **20**.

Further, the light emitting device package **100**C includes a light transmitting film **80** protecting the light emitting diode **20**, and a support member **95**C supporting the light transmitting film **80**.

Since the body **10**, insulating layers **10***a*, **10***b*, **10***c*, and **10***d*, the light emitting diode **20**, and the electrodes of the light emitting device package **100**C are similar in configuration to those of the light emitting device package **100** of FIGS. **1** to **3**, a description thereof will be omitted.

Referring to FIG. **8**, the light emitting device package **100**C further includes a plurality of coupling protrusions **98** protruding from the top surface of the support member **95**C, and a plurality of coupling recesses **82** disposed in the light transmitting film **80**. The coupling recesses **82** are aligned with the coupling protrusions **98**, and receive the coupling protrusions **98**.

The coupling protrusions **98** may be formed of the same material as that of the support member **95**C.

The coupling protrusions **98** are caught in the coupling recesses **82**, so that the light transmitting film **80** can seal a cavity **15**. An adhesive **92** is applied between the light transmitting film **80** and the top surface of the support member **95**C.

The adhesive **92** may be a Ag paste, a UV adhesive, Pb-free low temperature glass, an acrylic adhesive, or a ceramic adhesive.

As such, the light transmitting film **80** is caught by the support member **95**C with the adhesive **92** applied therebetween, thereby improving coupling force thereof.

Hereinafter, a light emitting device package according to a fifth embodiment will now be described with reference to FIG. **9**.

Referring to FIG. **9**, a light emitting device package **100**D includes: a body **10** formed of ceramic; at least one light emitting diode **20** disposed on the body **10**; and first and second electrodes (not shown) disposed on the body **10**, and electrically connected to the light emitting diode **20**.

Further, the light emitting device package **100**D includes a light transmitting film **80** protecting the light emitting diode **20**, and a support member **95**D supporting the light transmitting film **80**.

Since the body **10**, insulating layers **10***a*, **10***b*, **10***c*, and **10***d*, the light emitting diode **20**, and the electrodes of the light emitting device package **100**D are similar in configuration to those of the light emitting device package **100** of FIGS. **1** to **3**, a description thereof will be omitted.

Referring to FIG. **9**, the light emitting device package **100**D includes adhering holes **83** disposed in the light transmitting film **80** on the body **10**, and formed in a region contacting the top surface of the support member **95**D.

An adhesive **84** is applied between the light transmitting film **80** and the top surface of the support member **95**D.

The adhesive **84** may be a Ag paste, a UV adhesive, Pb-free low temperature glass, an acrylic adhesive, or a ceramic adhesive. The adhesive **84** is applied, and then, the light transmitting film **80** and the support member **95**D are pressed. Accordingly, the adhering holes **83** are filled with the adhesive **84**, and then the adhesive **84** is cured.

Thus, the light transmitting film **80** is attached to the support member **95**D with the adhesive **84** therebetween, and simultaneously, the adhering holes **83** are physically coupled to the adhesive **84**, thereby improving coupling force of the light transmitting film **80** and the support member **95**D.

Although the adhering holes **83** are disposed in the light transmitting film **80**, adhering recesses that are filled with the adhesive **84** may be disposed therein, and thus, the present disclosure is not limited to the adhering holes **83**.

FIG. **10** is a cross-sectional view illustrating a light emitting device package according to a sixth embodiment.

Referring to FIG. **10**, a light emitting device package **100**E includes: a body **10** formed of ceramic; at least one light emitting diode **20** disposed on the body **10**; and first and second electrodes (not shown) disposed on the body **10**, and electrically connected to the light emitting diode **20**.

Further, the light emitting device package **100**E includes a light transmitting film **80** protecting the light emitting diode **20**, and a support member **95**E supporting the light transmitting film **80**.

Since the body **10**, insulating layers **10***a*, **10***b*, **10***c*, and **10***d*, the light emitting diode **20**, and the electrodes of the light emitting device package **100**E are similar in configuration to those of the light emitting device package **100** of FIGS. **1** to **3**, a description thereof will be omitted.

Referring to FIG. **10**, the light emitting device package **100**E includes heat dissipation holes **14** within the body **10** under a cavity **15** to transfer heat from the light emitting diode **20** to a heat dissipation member **90**.

The heat dissipation holes **14** pass through the body **10** from the bottom of the cavity **15** to the heat dissipation member **90**, and may be disposed under the light emitting diode **20**.

The heat dissipation member **90** may be formed of a material having heat conductivity higher than that of the body **10**. The heat dissipation holes **14** are formed by punching holes in the ceramic constituting the first insulating layer **10***a* before firing the first insulating layer **10***a*.

Although heat can be transferred through the spaces within the heat dissipation holes **14** by convection, the heat dissipation holes **14** may be filled with a material having heat conductivity higher than that of the body **10**.

The light transmitting film **80** may be adhered to the support member **95**E according to one of the embodiments of FIGS. **4** to **9**. Alternatively, as illustrated in FIG. **10**, glass protrusions **86** may be disposed on the light transmitting film **80**, and recesses **99** aligned with the glass protrusions **86** may be disposed on the top surface of the support member **95**E, so that the light transmitting film **80** can be adhered to the support member **95**E with the glass protrusions **86** being fitted in the recesses **99**.

In this case, an adhesive **87** may be applied between the light transmitting film **80** and the top surface of the support member **95**E, thereby improving coupling force of the light transmitting film **80** and the support member **95**E.

FIG. **11** is a perspective view illustrating a light emitting device package according to a seventh embodiment.

Referring to FIG. **11**, a light emitting device package **100**F includes: a body **10** formed of ceramic; at least one light emitting diode **20** disposed on the body **10**; and first and second electrodes **31** and **32** disposed on the body **10**, and electrically connected to the light emitting diode **20**.

Further, the light emitting device package **100**F includes a light transmitting film **80** protecting the light emitting diode **20**, and a support member **95** supporting the light transmitting film **80**.

Since the body **10**, insulating layers **10***a*, **10***b*, **10***c*, and **10***d*, the light emitting diode **20**, and the electrodes **31** and **32** of the light emitting device package **100**F are similar in configuration to those of the light emitting device package **100** of FIGS. **1** to **3**, a description thereof will be omitted.

The light emitting diode **20** may be an ultraviolet light emitting diode having a wavelength ranging from about 245 nm to 405 nm. That is, the light emitting diode **20** may emit an ultraviolet ray having a short wavelength of about 280 nm, or an ultraviolet ray having a long wavelength of about 365 nm or 385 nm.

The light emitting diode **20** as an ultraviolet light emitting diode may be adhered to the second electrode **32** through a conductive adhesive, and be electrically connected to the first electrode **31** through a wire **22**. The light emitting diode **20** may be mounted using a wire bonding method, a die bonding method, or a flip bonding method, which may be selected according to the type of a chip and the position of an electrode of the chip.

The light emitting device package **100**F further includes a color light emitting diode **30** and a Zener diode **35** within a cavity **15**, which are electrically connected to the light emitting diode **20**.

The color light emitting diode **30** may be a blue, green, or red light emitting diode, and be mounted on the second electrode **32**, together with the light emitting diode **20**, so that the color light emitting diode **30** can be electrically connected to the second electrode **32**. In addition, the color light emitting diode **30** may be connected to the first electrode **31** through a wire (not shown).

When the color light emitting diode **30** is connected in parallel to the light emitting diode **20**, the color light emitting diode **30** and the light emitting diode **20** operate in the same manner. At this point, the color light emitting diode **30** emits color light, so that it can be perceived by a naked eye whether the light emitting diode **20** operates.

Alternatively, the color light emitting diode **30** may receive power from a separate electrode (not shown) to perform a pulse type light emitting operation in which light is emitted only at a start point when the light emitting diode **20** starts to operate.

Reverse current may be guided to the Zener diode **35** disposed within the cavity **15** to protect the light emitting diode **20**. The Zener diode **35** is disposed on a dummy electrode **33**, and may receive power from a separate terminal.

The color light emitting diode **30**, the Zener diode **35**, and the light emitting diode **20** may be disposed within the cavity **15**. The light transmitting film **80** may be coupled to the body **10** according to one of the embodiments of FIGS. **4** to **10**.

According to the embodiments, an ultraviolet light emitting device package includes a ceramic body to efficiently dissipate heat, and a glass film is directly attached to the ceramic body to decrease the number of components, thereby simplifying the manufacturing process thereof, and reducing the manufacturing costs thereof.

The ceramic body is coupled to the glass film through an adhesive and a screw member, without using laser or soldering, thereby improving assembly efficiency.

In addition, the ultraviolet light emitting device package can be compatible with various light emitting diodes for emitting ultraviolet rays of a wavelength ranging from about 245 nm to 405 nm.

Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this disclosure. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

What is claimed is:

1. An ultraviolet light emitting device package comprising:

a body comprising ceramic insulating layers defining a cavity having a bottom;

an ultraviolet light emitting diode disposed within the cavity;

a first electrode and a second electrode, which are spaced apart from each other on the body, and are electrically connected to the ultraviolet light emitting diode;

a support member disposed on the body, and surrounding the cavity; and

a glass film coupled to the support member, and covering the cavity,

wherein the first electrode being disposed on one of the ceramic insulating layers and the second electrode being disposed on an other of the ceramic insulating layers, and

wherein the ceramic insulating layers comprise;

a first insulating layer exposed on the bottom of the cavity;

a second insulating layer disposed on the first insulating layer; and

a third insulating layer exposing a portion of the second insulating layer,

wherein the first electrode is exposed on the second insulating layer, the second electrode is exposed on the first insulating layer and the second insulating layer.

2. The ultraviolet light emitting device package according to claim **1**, wherein the cavity has a side step structure,

the first electrode is exposed to the side step structure of the cavity, and

the second electrode is exposed to a bottom of the cavity.

3. The ultraviolet light emitting device package according to claim **2**, wherein the first and second electrodes are connected to a pad surrounding an outer surface of the body, and disposed on a bottom surface of the body.

4. The ultraviolet light emitting device package according to claim **3**, wherein the first and second electrodes have a multi-layered structure.

5. The ultraviolet light emitting device package according to claim **4**, wherein the first and second electrodes are alternately formed with the ceramic insulating layers.

6. The ultraviolet light emitting device package according to claim **5**, wherein the support member comprises at least one coupling protrusion on a top surface thereof, and

the glass film comprises at least one coupling recess in which the coupling protrusion is fitted.

7. The ultraviolet light emitting device package according to claim **5**, wherein the support member comprises at least one coupling recess in a top surface thereof, and

the glass film comprises at least one coupling protrusion is fitted in the coupling recess.

8. The ultraviolet light emitting device package according to claim **5**, further comprising at least one fixing pin fixing the glass film and the support member.

9. The ultraviolet light emitting device package according to claim **8**, wherein the fixing pin comprises:

a pin head having a diameter greater than a diameter of a through hole of the glass film; and

a pin body extending from the pin head, and fitted in the through hole.

10. The ultraviolet light emitting device package according to claim **9**, wherein the pin body comprises a screw thread protrusion on an outer surface thereof.

11. The ultraviolet light emitting device package according to claim **5**, wherein an adhesive member is disposed between a top surface of the support member and the glass film.

12. The ultraviolet light emitting device package according to claim **11**, wherein the adhesive member comprises an ultraviolet adhesive.

13. The ultraviolet light emitting device package according to claim **12**, wherein the glass film comprises at least one adhering hole filled with the adhesive member.

14. The ultraviolet light emitting device package according to claim **5**, wherein the support member comprises a recess in an inner surface thereof, and

the glass film is slid in the recess.

15. The ultraviolet light emitting device package according to claim **5**, wherein the body comprises at least one heat dissipation hole extending from the bottom of the cavity to the bottom surface of the body.

16. The ultraviolet light emitting device package according to claim **1**, wherein the support member is integrally formed with the body.

17. The ultraviolet light emitting device package according to claim **1**, further comprising a color light emitting diode within the cavity of the body to display an operation of the ultraviolet light emitting diode.

18. The ultraviolet light emitting device package according to claim **5**, further comprising a Zener diode within the cavity of the body,

wherein an overcurrent flowing to the ultraviolet light emitting diode flows to the Zener diode.

19. The ultraviolet light emitting device package according to claim **18**, further comprising a dummy electrode disposed on the body, and the Zener diode is connected to the dummy electrode.

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